DOE Facility Interactions of the Neutron & X-Ray Scattering Group

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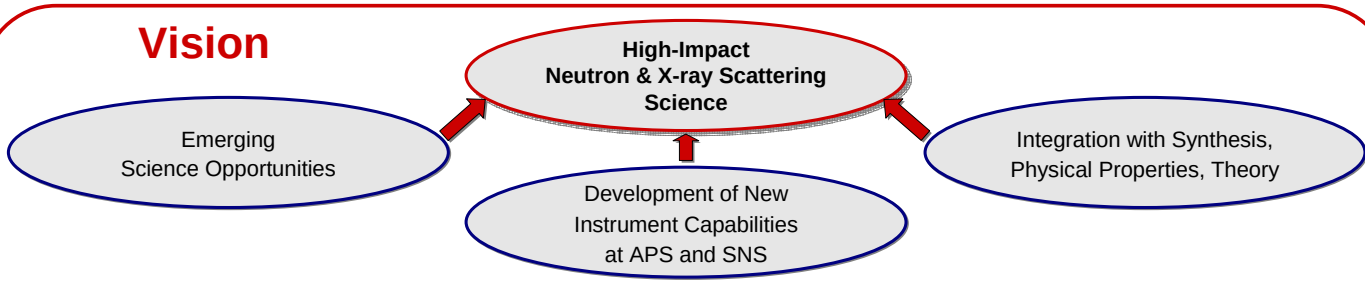
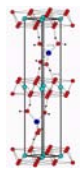
Vision



- Pursue world-class science through comprehensive programs that integrate MSD strengths.
- Develop new scattering instrumentation and methods that address important emerging science questions.
- Strengthen the US scattering community and enable them to exploit advanced scattering techniques.

Science

Structure-property relationships in novel superconductors and other complex oxides

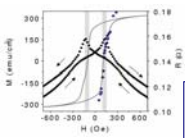


$Na_xCoO_2 \cdot 4xH_2O$

Neutron Powder Diffraction probes the ordering phenomena, defect concentrations, and charge states of complex oxides.
Facilities: APS, IPNS, SNS

Future Directions
High-pressure synthesis can
- Extend solubility limits
- Stabilize higher oxidation states
- Stabilize novel structural phases

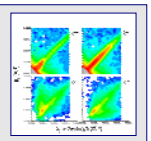
Magnetic behavior in constrained geometries



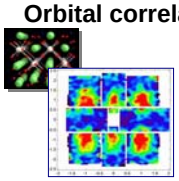
GMR in High-T_c/CMR Superlattices

Polarized Neutron Reflectometry probes the layer and interface properties of heterostructures.
Facilities: IPNS, LANSCE, SNS

Future Directions
- Magnetic domains and patterned nanoparticles.
- At IPNS, we have installed a wide-angle polarization analyzer.



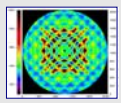
Orbital correlations, frustration, and self-organization



Orbitally-induced Dimerization in $La_4Ru_2O_{10}$

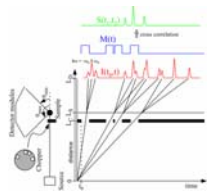
Neutron and X-ray scattering probes the orbital physics of transition metal oxides.
Facilities: APS, ESRF, ILL, ISIS, NIST, SNS

Future Directions
- Nanoscale self-organization induced by competing interactions.
  - phase separation, dimerization, stripes



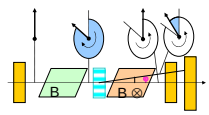
Instrumentation

Single crystal diffuse scattering with elastic discrimination (Corelli)



- Diffuse scattering is a powerful probe of nanoscale disorder.
- Prototype under construction at IPNS. DOE funding: $797K
- Proposal for a dedicated SNS instrument will be submitted in 2006.

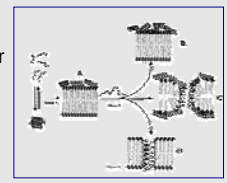
Spin echo resolved grazing incidence scattering (SERGIS)



- 10^4 gain in intensity of grazing incidence scattering!
- Feasibility tests were completed in 2005. DOE funding: $916K
- Proposal for a dedicated SNS instrument will be submitted in 2006.

Biological and polymeric membranes

- SERGIS will be an effective probe of complex biomimetic membrane disorder caused by bio-active molecules.
- In conjunction with SERGIS proposal at SNS, we propose to establish a new scientific program in our group.



Alternative interactions of peptides and lipid bilayers

Community Interactions

National School of Neutron and X-ray Scattering

- Unique in the US (neutron + x-ray).
- Founded in 1999, by Gian Felcher.
- Chaired by group ever since.
- Teaches 60 graduate students per year.
- At least two times oversubscribed.

Spallation Neutron Source

- Members of Instrument Advisory or Development Teams of six instruments (ARCS, Liquids & Magnetism Reflectometer, POWGEN, SEQUOIA)
- Members of executive committee of two instruments (ARCS, POWGEN)
- Letter of Intent submitted for one instrument (Corelli) and to be submitted in 2006 for another instrument (SERGIS).
- Chair of NeXus International Advisory Committee. NeXus is the data format standard adopted by the SNS.

ARGONNE NATIONAL LABORATORY

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